

# Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/CA05/000190

International filing date: 14 February 2005 (14.02.2005)

Document type: Certified copy of priority document

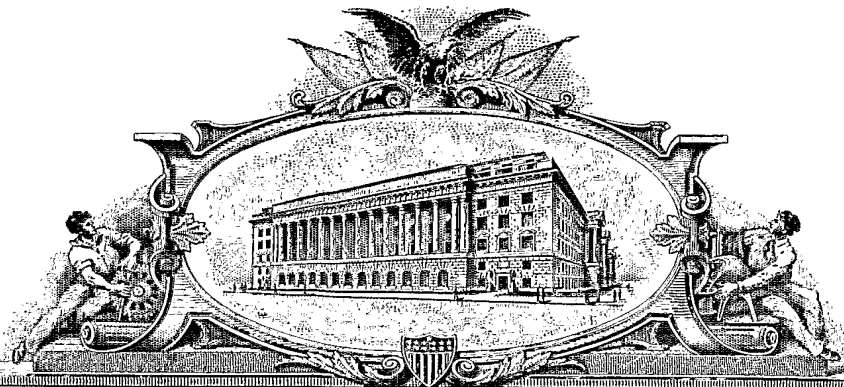
Document details: Country/Office: US  
Number: 60/543,926  
Filing date: 13 February 2004 (13.02.2004)

Date of receipt at the International Bureau: 27 April 2005 (27.04.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)



World Intellectual Property Organization (WIPO) - Geneva, Switzerland  
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse



# THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

February 24, 2005

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE UNDER 35 USC 111.

APPLICATION NUMBER: 60/543,926

FILING DATE: February 13, 2004

PCT/CA 05/00190

By Authority of the  
COMMISSIONER OF PATENTS AND TRADEMARKS



*H. L. Jackson*  
H. L. JACKSON  
Certifying Officer

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

**PROVISIONAL APPLICATION FOR PATENT COVER SHEET**

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

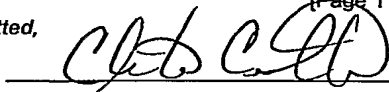
Express Mail Label No.

INVENTOR(S)					
Given Name (first and middle (if any))	Family Name or Surname	Residence (City and either State or Foreign Country)			
Chau Thien	Vo	Roxboro, Québec, Canada			
<input type="checkbox"/> Additional inventors are being named on the _____ separately numbered sheets attached hereto					
TITLE OF THE INVENTION (500 characters max)					
FILTRATION SYSTEM AND METHOD					
Direct all correspondence to: CORRESPONDENCE ADDRESS					
<input checked="" type="checkbox"/> Customer Number		020988			
OR					
<input type="checkbox"/> Firm or Individual Name					
Address					
Address					
City	State	ZIP			
Country	Telephone	Fax			
ENCLOSED APPLICATION PARTS (check all that apply)					
<input checked="" type="checkbox"/> Specification Number of Pages		25	<input type="checkbox"/> CD(s), Number		
<input checked="" type="checkbox"/> Drawing(s) Number of Sheets		9	<input type="checkbox"/> Other (specify)		
<input type="checkbox"/> Application Data Sheet, See 37 CFR 1.76					
METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT					
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27					FILING FEE AMOUNT (\$)  80.00
<input type="checkbox"/> A check or money order is enclosed to cover the filing fee					
<input checked="" type="checkbox"/> The Director is hereby authorized to charge filing Fees or credit any overpayment to Deposit Account Number: 19-5113					
<input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached					
The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.					
<input checked="" type="checkbox"/> No.					
<input type="checkbox"/> Yes, the name of the U.S. Government agency and the Government contract number are: _____					

[Page 1 of 2]

Respectfully submitted,

SIGNATURE



Date

February 12, 2004

TYPED or PRINTED NAME

Christian CAWTHORN

REGISTRATION NO.  
If appropriate)

47,352

TELEPHONE

(514) 847-4256

Docket Number:

14566-3uspr PTN/df

## FILTRATION SYSTEM AND METHOD

## BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention generally relates to a filtration system and method of use of the filtration system and, more particularly but not exclusively, to a filtration system and method for use in the printing industry to filter out byproducts of plate-making processes from the air.

2. Background Art

[0002] Air filtration systems are employed to filter airborne contaminants from the air. These systems typically comprise an enclosure with an air intake allowing air into the system, one or more filters for particulate and/or chemical vapor capture, a flow-creating device (e.g., fans or blowers), all of which cooperate to filter byproducts from the air.

[0003] Some systems are hermetically sealed and use HEPA filters (i.e., High Efficiency Particulate Arrestation filters, having 99.97 to 99.99% efficiency at 0.3 microns) to permit a superior level of filtration, and are employed especially to provide clean air, for instance to pressurize an enclosed space so as to make the enclosed space generally free of exterior environmental airborne contaminants. Applications include providing clean air to pre-press equipment, hospital clean-rooms, etc. Likewise, such systems can be used to extract contaminated air from isolation rooms safely, and with the aid of hoods to extract chemical vapors from areas in the vicinity of the hood.

[0004] The order of the components of such systems is generally not important for the system to function, however systems that require a high level of efficiency, especially in areas with high particle count or particulate sensitive equipment, benefit from placing a primary particulate filter (a cellulose or HEPA filter) in advance of the other

components (e.g., HEPA filter, flow-creating device, carbon chemical filter, and the like) to prevent contamination of these components from the particulate by capturing most particulate upstream of these components. For example, a HEPA filter can be employed before an activated carbon filter to capture acrolein to extend the lifespan of the activated carbon filter. These primary filters are subject to a greater degree of particulate saturation and therefore often have the shortest lifespan and need replacement often.

[0005] Methods employed to extend the lifespan of the primary filter include blowback systems using compressed air to dislodge particulate from the filter outward against the nominal direction of the airflow. Methods, such as a funnel leading to a conveyor that transfers material to an enclosed chamber, are employed to capture particulate blown back out of the filter to prevent exterior contamination or re-saturation of the filter with this particulate.

[0006] In the printing industry, a pre-press process involves the thermal laser ablation of printing plates (e.g., using computer-to-plate equipment) in order to create images on those plates. The plates will be used thereafter to transfer an ink image onto a medium. The laser ablation process creates undesired byproducts. For example, particulates referred to as "carbon black," as well as chemical vapors and odors deriving thereof, such as aldehyde, formaldehyde and acrolein, result from the laser ablation of the plates.

[0007] The printing equipment is sensitive to such particulates, and chemical vapor byproducts of the laser ablation process are hazardous to human health. Accordingly, filtration and adsorption systems are often associated with pre-press equipment in order to remove the byproducts from the air.

[0008] Various equipment is used to filter particulate matter and adsorb chemical vapors from the air and/or to maintain environmental conditions at acceptable levels for both equipment and human exposure, in a pre-press

environment, for example. Suitable filters (e.g., dust filters, HEPA filters) are used for particulate filtration, whereas chemical filters (e.g., active-carbon filters) are used for the adsorption of chemical vapors.

[0009] A specified filtration rate must be maintained for the filtration and adsorption system to keep both the environment and the equipment clean. The rate of filtration and adsorption is reduced as the medium for particulate filtration becomes saturated with particulate. In addition, a conventional unidirectional airflow particulate filter has a lifespan defined by the point at which the specified filtration rate can no longer be achieved due to restrictive clogging caused by saturation with particulate matter. Likewise, chemical filters have a lifespan determined by the inability to adsorb more chemical vapor as the media for adsorption becomes saturated with chemicals. However, the saturation of the chemical filter does not affect the rate of airflow.

[0010] For example, particulate filters become clogged with particulates, thereby restricting airflow necessary to maintain specified filtration rates, whereby the particulate filters require changing. In the case of laser ablation byproducts, filters require frequent changing because of clogging by "carbon black" particulates. The changing of filters causes an exposure of maintenance personnel to the particulates (e.g., carbon black) of the filters. Moreover, the changing of filters possibly involves the release of carbon-black particulates into the surrounding environment.

[0011] Some filtering systems have combined particulate filtration and chemical filtration capabilities. For instance, Quatro Air Technologies has a filter system model AMS-300EP, which houses in a single cabinet several filters for particulate and a filter for chemical vapors stacked one on top of the other, with a single access at one end of the cabinet. It only may be necessary, however, to change one of these filters at any given time. However, the configuration of the assembly of filters within the cabinet

necessitates handling of other filters that are on top of the filter that needs to be changed. The changing of the chemical filter (i.e., the bottommost one) causes an exposure of the maintenance personnel to the particulate filters, and possibly a release of the particulate to the surrounding environment.

[0012] In view of these issues, it would be desirable to provide a filtration system in which the exposure of the maintenance personnel to laser ablation byproducts collected by the filters is limited during filter changes. Moreover, it would be desirable to increase the life of the filters in filtration systems in order to reduce recurring costs from filter changeover, to reduce exposure of the contents of the filters to maintenance personnel, and to reduce the costs of maintenance.

#### SUMMARY OF INVENTION

[0013] It is therefore a feature of the present invention to provide a novel filtration system.

[0014] It is a further feature of the present invention to provide a filtration system that substantially overcomes the disadvantages of the prior art.

[0015] It is a still further feature of the present invention to provide a novel blowback system that discharges particulate captured in particulate filters to prolong the usable life of those filters.

[0016] It is a still further feature of the present invention to provide a blowback system having an internal, self-contained flow generator.

[0017] It is a still further feature of the present invention to include a novel blowback trap to capture particulate blown back to prevent exterior contamination or re-saturation of the filter with this particulate.

[0018] It is a still further feature of the present invention to provide a filtration system that reduces

exposure of maintenance personnel to used filters during filter replacement.

[0019] It is a still further feature of the present invention to provide a filtration system in which the assembly or disassembly of a particulate filter to the device is separate from the assembly or disassembly of a chemical filter, and likewise each of a multiple of particulate filters are individually assembled or disassembled to the device to limit unnecessary manipulation of other components of the device during filter changes.

[0020] It is a still further feature of the present invention to provide a filtration system having a housing containing a filter or filters that is configured to be attachable to the device securely and hermetically in the fashion of a reusable cartridge, said housing providing a generally closed containment for a single use filter or filters with the exception of air intake and exhaust access points that, upon removal, acts to contain the filter(s) and limit exposure of its trapped contents to the environment or handlers, a housing that provides a measure of containment that constitutes a clean and safe means of disposing of the spent filter(s) with minimal contact to the filter, that facilitates a simpler process of filter changeover.

[0021] It is a still further feature of the present invention that the filtration system alternatively have a disposable replaceable cartridge where no contact with the filter or internal, contaminated surfaces of the housing are required, the cartridge comprising a housing that is a nominally sealed vessel permanently entrapping the filter (the filter is disposed of with the cartridge as a unit), with air intakes that can be covered and sealed.

[0022] It is a still further feature of the present invention that the filtration system alternatively have end caps to cover the air intake and exhaust to seal the housing.

[0023] It is a still further feature of the present invention that the filtration system alternatively have a



replaceable cartridge comprising a housing containing a primary filter leading to a plenum leading to a secondary, activated carbon filter, and access for an imbedded blowback device which acts across the plenum to dislodge particulate from the primary filter, the blowback device being integral to the main chassis and not having to be removed when the removable filter cartridge is removed.

[0024] It is a still further feature of the present invention to provide a method of using the above-described filtration system.

[0025] It is a still further feature of the present invention to provide a method of filtering byproducts of a printing process in which particulate filtration components are separated from chemical filtration components.

[0026] It is a still further feature of the present invention to provide a filtration system which includes a novel blowback system that discharges particulate captured in particulate filters to prolong the usable life of those filters for use in military land vehicles (e.g., tanks, armored vehicles) exposed to high dust environments (e.g., deserts), such that the filtration system supplies the occupants with clean air.

[0027] It is a still further feature of the present invention to provide a filtration system which includes a novel blowback system that discharges particulate captured in particulate filters to prolong the usable life of those filters for use on the combustion engine air intake system in military land vehicles exposed to high dust environments (e.g., deserts).

[0028] It is a still further feature of the present invention to provide a filtration system which includes a novel blowback system that discharges particulate captured in particulate filters to prolong the usable life of those filters for use in military tents and medical tent exposed to high dust environments (e.g., deserts).

[0029] In accordance with the present invention, there is provided a filtration system having a blowback system

employing an internal, autonomous (i.e., not requiring an external method of gas delivery) self-contained flow generator that does not require filtering or drying of the gas, such as CO<sub>2</sub> cartridge, electromechanical diaphragm (i.e., audio speaker and amplifier), mechanical piston, high-pressure blower fan, on-board pre-filtered, oil-free and dried compressed air canister, or an oilless air compressor and dryer located within the system that draws air downstream through the filter.

[0030] The filtration system of the present invention uses a high-strength PTFE, HEPA or ULPA filter that provides high-efficiency filtration while withstanding blowback pressures.

[0031] Therefore, in accordance with the present invention, there is provided an apparatus for filtering particulates from a fluid, comprising a casing defining an inner cavity having an inlet adapted to receive a flow of fluid, such that fluid enters the inner cavity, and an outlet through which fluid exits the inner cavity; a filter associated with the outlet such that fluid exiting the inner cavity through the outlet passes through the filter, the filter being adapted to retain particulates beyond a predetermined size from a fluid flowing therethrough; and a blowback generator adapted to cause a reverse flow of fluid through the outlet and into the inner cavity of the casing, so as to dislodge a portion of the particulates retained in the filter into the inner cavity.

[0032] Further in accordance with the present invention, there is provided an apparatus for filtering particulates and an undesired gas from a main gas, comprising a particulate treatment station having a first inlet adapted to receive a main gas carrying particulates and an undesired gas, a first filter for retaining the particulates in the particulate treatment station, and a first outlet through which the main gas exits filtered of the particulates; a chemical treatment station separated from the particulate treatment station and having a second inlet in fluid

communication with the first outlet of the particulate treatment station so as to receive a supply of the main gas from the first outlet of the particulate treatment station, a second filter for reacting with the undesired gas to retain the undesired gas therein, and a second outlet through which the main gas exits filtered of the undesired gas; and a pressure differential system to cause a flow of the main gas through the particulate treatment station and the chemical treatment station.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0033] Having thus generally described the nature of the invention, reference will now be made to the accompanying drawings, showing by way of illustration a preferred embodiment thereof and in which:

[0034] Fig. 1 is a perspective view of a filtration system in accordance with a first embodiment of the present invention;

[0035] Fig. 2 is a perspective view, partially fragmented, of the filtration system of the present invention, showing an interior of a particulate treatment station;

[0036] Fig. 3 is a perspective view of a chemical treatment station of the filtration system of the present invention, with a cover of the chemical treatment station in an open position;

[0037] Fig. 4 is a perspective view of the chemical treatment station, with the cover in the open position, and a motor plate also in the open position to show an interior of the chemical treatment station;

[0038] Fig. 5 is a perspective view of the chemical treatment station of Fig. 4, with a filter portion shown partially removed from a motor portion;

[0039] Fig. 6 is an enlarged view of the motor plate of the chemical treatment station of Fig. 4;

40

[0040] Fig. 7 is a perspective view of a filtration system in accordance with a second embodiment of the present invention;

[0041] Fig. 8 is a side elevation view, partly sectioned, of the filtration system of Fig. 7;

[0042] Fig. 9 is a perspective view, partly fragmented, of a filtration system in accordance with a third embodiment of the present invention; and

[0043] Fig. 10 is a perspective view, partly fragmented, of a filtration system in accordance with a fourth embodiment of the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0044] Referring to the drawings, and more particularly to Fig. 1, a filtration system in accordance with the first embodiment of the present invention is generally shown at 10. The filtration system 10 has a particulate treatment station 20 and a chemical treatment station 100.

[0045] The particulate treatment station 20 is used to filter particulates from a gas (e.g., air), so as to substantially free the gas of particulates, for instance, above a predetermined size.

[0046] The chemical treatment station 100 is used to remove a secondary unwanted gas (e.g., chemical vapors such as aldehyde and formaldehyde) from a main gas (e.g., air).

[0047] As will be described hereinafter, the particulate treatment station 20 and the chemical treatment station 100 are serially positioned with respect to one another in terms of a segment of airflow moving from one component to the other over time in accordance with a first embodiment of the present invention. More specifically, in the first embodiment, the particulate treatment station 20 is upstream of the chemical treatment station 100 for the filtration system 10. Accordingly, a gas is subjected to particulate filtration prior to being cleaned of unwanted chemical vapors.

#### Particulate Treatment Station 20

[0048] Referring concurrently to Figs. 1 and 2, the particulate treatment station 20 is shown having a first casing 22, and a second casing 24 on top of the first casing 22. As seen in Fig. 2, the first casing 22 and the second casing 24 are in fluid communication with one another through aperture 26.

[0049] The first casing 22 receives a gas input and filters the gas from particulates.

[0050] The second casing 24 exhausts the clean gas, and is used to clean the filter within the first casing 22.

[0051] Referring to Fig. 1, the first casing 22 has an inlet 30. The inlet 30 is illustrated having a tubular shape so as to be connected to a pipe or the like, to receive an inflow of a gas (e.g., air) that must be cleaned. Within the first casing 22, a cylindrical filter 32 is in an upstanding position, such that an inner cylindrical cavity of the cylindrical filter 32 is upstanding. Although not visible in Fig. 1, the inner cavity of the cylindrical filter 32 is the hollow cavity that receives the gas that has passed through the filter walls of the cylindrical filter 32. A top circular end of the inner cavity of the cylindrical filter 32 is in register with the aperture 26 through which fluid communication occurs between the first casing 22 and the second casing 24.

[0052] At the bottom of the first casing 24, a plurality of slats 34 are positioned side by side so as to define particulate-receiving slots 36, between adjacent slots 34. The cylindrical filter 32 sits on upper ends of the slats 34. It is pointed out that the cylindrical filter 32 is sealingly connected to an upper wall of the first casing 22, such that the aperture 26 between the first casing 22 and the second casing 24 is opened only to the inner cylindrical cavity of the cylindrical filter 32. Moreover, a bottom circular end (not shown) of the inner cylindrical cavity is blocked, such that a gas that enters the inner cylindrical

cavity from the first casing 22 must pass through the filter walls of the cylindrical filter 32.

[0053] As best seen in Fig. 2, the second casing 24 has an outlet 40, of tubular shape, by which the particulate treatment station 20 may be connected through a hose to the chemical treatment station 100, or to a diffuser if no chemical treatment is necessary. Alternatively, the outlet 40 may be a diffuser, once more if no chemical treatment is necessary.

[0054] The second casing 24 has a blowback generator 42. The blowback generator 42 is used to create a flow of gas from the second casing 24 through the aperture 26, and into the first casing 22. This reverse flow of gas will be received in the cylindrical cavity of the inner cylindrical filter 32, so as to exert pressure on the particulates stuck in the filter walls of the cylindrical filter 32. This will be described in further detail hereinafter.

[0055] A nozzle 44 is optionally provided in the second casing 24. The nozzle 44 is positioned between the blowback generator 42 and the aperture 24, so as to create an increase in flow to enhance the blowback of gas into the inner cavity of the cylindrical filter 32. Also, a spacer (e.g., conically shaped solid volume) may be inserted concentrically into the inner cylindrical cavity of the cylindrical filter 32, also in view of enhancing the blowback effect.

#### Operation of the Particulate Treatment Station 20

[0056] The first casing 22 of the particulate treatment station 20 receives an inflow of gas to be treated. Once received in the first casing 22, the gas will pass through the filter walls of the cylindrical filter 32, so as to reach the second casing 24 through the inner cylindrical cavity of the cylindrical filter 32 and through the aperture 26. The cylindrical filter 32 will filter out any particulate beyond a predetermined size, such that the gas going beyond the filter walls of the cylindrical filter 32

and reaching the second casing 24 is free of unwanted particles. The filtered-out particles will accumulate in the cylindrical filter 32. The cleaned-up gas will exit the second casing 24 through the outlet 40.

[0057] Periodically, a blowback will be triggered so as to blow the particles accumulated in the filter walls of the cylindrical filter 32 out thereof. Accordingly, the blowback generator 42 is activated to create a reverse flow of gas from the second casing 24 to the first casing 22 through the aperture 26. The pressure differential across the cylindrical filter 32 will build in the cylindrical filter 32 and will result in a flow of gas from the inner cylindrical cavity of the filter 32, through the filter walls of the filter 32, and into the first casing 22. This reverse flow will result in removal of the particulates out of the filter 32 and within a remainder of the first casing 22. By settling, the particulates will accumulate in the particulate-receiving slots 36.

[0058] Once a sufficient blowback is achieved, the flow will return to its normal direction for filtering, as described previously, with the cylindrical filter 32 having been cleaned out. It is pointed out that a blower ventilator or other flow-creating device can be positioned upstream or downstream of the particulate treatment station 20 to cause the flow of gas in the normal direction.

[0059] The particulates accumulated in the particulate-receiving slots 36 will be protected from the inflow of gas during normal operation of the particulate treatment station 20. Accordingly, air blown into the first casing 22 will be directed to the cylindrical filter 32 without entraining the particulates gathered in the particulate-receiving slots 36.

[0060] It is pointed out that the filter 32 is chosen as a function of the particulates to be removed. For instance, cellulose filters, HEPA filters, PTFE filters are various options of filter that are to be considered in view of the particulates to be removed.

#### Blowback Generator 42

[0061] Various types of flow generators can be used for the present invention. Preferably, the blowback generator 42 is a vortex generator. The vortex generator turns an electrical signal into a mechanical displacement of a diaphragm at a given frequency, which will create a directional flow of the gas within the second casing 24. Therefore, the vortex generator is well suited to act as blowback generator 42, as it may be positioned directly above the aperture 26 so as to create a flow of gas through the aperture 26 and into the cylindrical filter 32. Moreover, the use of a vortex generator is advantageous in that it only requires an electrical signal to be operative, and is a low-maintenance system. The vortex generator will entrain the particulate-free gas from the second casing 24 into the first casing 22. Moreover, it is considered that the vortex generator creates a vibration that can dislodge particles from the cylindrical filter 32.

[0062] Alternatively, the blowback generator 42 may be a CO<sub>2</sub> canister. The CO<sub>2</sub> canister is well suited to be part of the particulate treatment station 20, as no treatment of the CO<sub>2</sub> is required prior to a blowback operation. However, the use of a CO<sub>2</sub> canister as blowback generator 42 is not as practical, as canisters must be replaced on a regular basis.

[0063] A compressed-air input from a local source could also be used for the blowback. However, a typical compressed-air output from a compressor must be freed of its oil content and moisture prior to being used with the particulate treatment station 20 of the present invention. Moreover, a local source (e.g., compressor) may not be available.

[0064] The particulate treatment station 20 of the present invention is advantageous in that no maintenance manpower is required to change filters. The particulates received in the cylindrical filter 32 are often hazardous to health, whereby it is advantageous to limit the exposure to these particulates. Therefore, it is contemplated to make



the first casing 22 disposable, such that, after a given amount of time using the filter 32 within the first casing 22, another first casing 22 replaces the previous one. As shown in Figs. 1 and 2, the second casing 24 has legs 46, at the bottom of which are provided casters 48 so as to facilitate the separation of the first casing 22 from the second casing 24. Moreover, the first casing 22 may also be provided with casters to facilitate the disposal thereof. The particulate treatment station 20 of the present invention increases the life of the filter by cleaning the latter, thereby limiting the necessity of a filter change. This results in a decrease in costs of filters. A fastening mechanism, such as latches, is used to secure the first casing 22 to the second casing 24.

#### Chemical Treatment Station 100

[0065] Referring to Fig. 1, the chemical treatment station 100 is shown positioned adjacent to the particulate treatment station 20. The chemical treatment station 100 receives a flow of gas free of unwanted particulates, and will clean the flow of gas from undesired chemical vapors. The chemical treatment station 100 therefore has active filter elements, as will be described hereinafter.

[0066] Referring to Fig. 3, the chemical treatment station 100 is shown having a motor portion 102 and a filter portion 104. In the illustrated embodiment, the motor portion 102 is positioned on top of the filter portion 104. The motor portion 102 is a flow generator, creating a pressure differential that will cause a flow of gas (i.e., air) through the chemical treatment station 100. In the illustrated embodiment, it is also the motor portion 102 that causes the flow of air through the particulate treatment station 20, for the removal of particulates from the air.

[0067] The chemical treatment station 100 has a cover 110 having an inlet 112. The inlet 112 is of tubular shape so as to be interconnected to the outlet 40 (Figs. 1 and 2) of

the particulate treatment station 20, for instance by a flexible duct or other similar conduit. Accordingly, an outflow of gas from the particulate treatment station 20 will reach the chemical treatment station 100 through the inlet 112.

[0068] The cover 110, shown in an open position in Figs. 3 to 6, is hinged to a remainder of the motor portion 102, such that a top end of motors 114 of the motor portion 102 can be accessed. Other configurations are possible (e.g., the cover 110 may be removable from a remainder of the motor portion 102, and be latched when connected thereto).

[0069] Referring to Fig. 4, the motors 114 are on a plate 116 that is also hinged to a remainder of the motor portion 102, whereby an underside of the motors 114 may be accessed. As an example, the motors 114 are Ametek Lamb Electric vacuum motors. The contact elements (i.e., brushes) of such motors must be changed on a periodic basis, as various steps are involved in changing these contact elements. For instance, the contact elements are retained on the motor chassis with threaded fasteners, which must be unsecured for a changing of contact elements. Accordingly, a changing of contact elements requires a nonnegligible maintenance time. Accordingly, as best shown in Fig. 6, brackets 120 support a plurality of contact elements 122, such that the contact elements 122 are in contact with the motors 114. The brackets 120 are fastened to plate 116 with threaded fasteners so as to be removable from a first position, as illustrated in Fig. 6, in which the contact elements 122 are in contact with the motors 114, and a second position in which the contact elements 122 are away from the motor 114, whereby they can readily be removed.

[0070] Returning to Fig. 4, the plate 116 is flipped open to its open position to expose the inner cavity 118 of the motor portion 102. Gas (i.e., air) will flow through the inner cavity 118 to reach the filter portion 104. The filter portion 104 encloses filters/filtration systems that

are associated with the byproduct chemical vapors that are to be removed from the main gas (e.g., air in the present case). Examples of the types of filters/filtration systems include active carbon filters and other chemical and odor filters, to remove gases such as aldehyde, formaldehyde, acrolein.

[0071] The filter portion 104 has a casing 130 having an inlet face 132 and an outlet face 134. The casing 130 is on casters 136, so as to be displaced. The previously described filters/filtration systems are generally shown at 138, between the inlet face 132 and the outlet face 134, whereby gas/air exiting the filter portion 104 by the outlet face 134 will have gone through the filters/filtration systems 138.

[0072] It is required to change the filters/filtration systems 138 on a periodic basis. It is, however, desired to limit the exposure of maintenance personnel to the filters/filtration systems 138, as some types of these filters are toxic. Advantageously, particulates have been removed from the gas to be treated in the particulate treatment station 20, whereby no dust filters are required to be replaced in this embodiment of the present invention.

[0073] Accordingly, the filters/filtration systems 138 are to be disposed of along with the filter portion 104 when required. More specifically, as shown in Fig. 5, the motor portion 102 is on legs 124, at the bottom of which casters 126 are provided. Accordingly, the motor portion 102 can be displaced away from the filter portion 104. The motor portion 102 and the filter portion 104 can be secured to one another using mechanical locks, such as latch mechanisms (not shown).

[0074] Therefore, when the filters/filtration systems 138 must be replaced, the casing 130 is rolled away and completely replaced by another one. As the particulates have been removed in the particulate treatment station 20, maintenance personnel attending to the motors 114 are not exposed to dirty particulate filters, which accumulate in

such motors when particulate filtration occurs downstream of these motors. Moreover, as the maintenance steps required for the chemical treatment station 100 are simplified in the present invention, the downtime due to the maintenance of the filtration system 10 is reduced.

#### Second Embodiment of the Present Invention

[0075] Referring to the drawings, and more particularly to Figs. 7 and 8, a filtration system in accordance with a second embodiment of the present invention is generally shown at 200. The filtration system 200 has a particulate treatment casing 202, a chemical treatment casing 204 and a motor unit 206.

[0076] The particulate treatment casing 202 is used to filter particulates from a gas (e.g., air), so as to substantially free the gas of particulate, for instance, above a predetermined size. The chemical treatment casing 204 is used to remove a secondary unwanted gas (e.g., chemical vapors such as aldehyde and formaldehyde) from a main gas (e.g., air). The motor unit 206 is used to generate a flow of the main gas through the filtration system 200, as well as to create a blowback in order to remove particulate from a filter of the particulate treatment casing 202.

[0077] Referring to Fig. 8, the particulate treatment casing 202 is shown having an inlet 210, an outlet 211 and an inner cavity 212. A main gas to be filtered (e.g., air) enters the inner cavity 212 through the inlet 210 and exits the inner cavity 212 through the outlet 211 in a normal filtering operation of the filtration system 20. A filter 213 blocks the outlet 211 such that air exiting the particulate treatment casing 202 through the outlet 211 must be filtered by the filter 213. The filter 213 may be various types, as described previously for the first embodiment, and is chosen as a function of the particulate to remove from the air.

[0078] Although not shown, particulate-capturing means, such as the slats 34/slots 36 of the first embodiment (e.g., as shown in Fig. 2), are provided at a bottom of the inner cavity 212 of the particulate treatment casing 202. Accordingly, the particulates removed by blowback from the filter 213 are captured in these means so as to prevent resaturation of the filter with these particulates.

[0079] Referring to Fig. 8, the motor unit 206 has an inlet 220 in fluid communication with the outlet 211 of the particulate treatment casing 202. The motor unit 206 has an outlet 221 and defines an inner cavity 222 through which the main gas (air) flows from the inlet 220 to the outlet 221 in the normal filtering operation of the filtration system 200. The motor unit 206 has a blowback generator 223 opposite the inlet 220, so as to generate a blowback through the outlet 211 and filter 213 of the particulate treatment casing 202, to remove particulates clogging up the filter 213. As mentioned previously, the blowback generator 223 may have various configurations, such as a vortex generator (as illustrated in Fig. 8, at 223), a CO<sub>2</sub> canister, or the like.

[0080] The inner cavity 222 also encloses a flow generator 224 (i.e., a vacuum, a blower, a fan or the like) to cause the flow of the main gas within the filtration system 200. It is pointed out that the flow generator 224 is positioned downstream of the filter 213, whereby particulates will generally be removed from the main gas (air) upon reaching the flow generator 224.

[0081] As seen in Fig. 7, the motor unit 206 has handles, one of which is shown at 225, for handling the filtration system 200 as a whole, or the motor unit 206.

[0082] Referring to Fig. 8, the chemical treatment casing 204 has an inlet 230, an outlet 231, and an inner cavity 232 through which the main gas flows from the inlet 230 to the outlet 231. A chemical vapor filter 233 is enclosed in the inner cavity 232. The inlet 230 of the chemical treatment casing 204 is in fluid communication with the outlet 221 of the motor unit 206.

[0083] Accordingly, the main gas (air), having entered the filtration system 200 through the inlet 210, is filtered in the particulate treatment casing 202. The flow generator 224 causes the air to flow from the particulate treatment casing 202 through the motor unit 206 and into the chemical treatment casing 204. Accordingly, the particulate treatment casing 202 and the chemical treatment casing 204 are secured to the motor unit 206 and sealed thereto in order for the flow of air to remain contained within the particulate casing 202 and chemical treatment casing, permitting the flow of air to pass through only inlet 210, the filter 213, the inlet 230, and the outlet 231.

[0084] The air is filtered from particulates in the particulate treatment casing 202 and is conveyed to the chemical treatment casing 204, whereat chemical vapors will be adsorbed by the chemical vapor filter 233.

[0085] When the filter 213 of the particulate treatment 202 is saturated with particulates (e.g., the pressure differential across the filter 213 is beyond a given limit), a blowback is initiated by the blowback generator 223, whereby filtered air within the motor unit 206 and/or the chemical treatment casing 204 will follow a reverse direction into the particulate treatment casing 202, so as to free the filter 213 from a portion of the particulates.

[0086] It is pointed out that the filtration system 200 is modular in that the motor unit 206 may be separated from the particulate treatment casing 202 and the chemical treatment casing 204. Accordingly, when the particulate treatment casing 202 and/or the chemical treatment casing 204 require changing, these may be removed from the motor unit 206. Latch mechanisms or the like may be used to releasably secure the motor unit 206 to the particulate treatment casing 202 and the chemical treatment casing 204.

### Third Embodiment of the Present Invention

[0087] Referring to Fig. 9, a filtration system in accordance with a third embodiment of the present invention

is generally shown at 250. The filtration system 250 has a particulate treatment section 252, a chemical treatment section 254 and a motor unit section 256.

[0088] The particulate treatment section 252 has an inlet 260, an inner cavity 261, a filter 262 at a top end of the inner cavity 261, and means 263 for capturing particulates.

[0089] The chemical treatment section 254 is positioned on top of the particulate treatment section 252, and is in fluid communication therewith. Accordingly, a main gas (air) that is filtered through the filter 262 of the particulate treatment section 252 is received in the chemical treatment section 254. A blowback generator 270 is centered in the chemical treatment section 254 and faces towards the filter 262 of the particulate treatment section 252. In Fig. 9, the blowback generator 270 is illustrated as a vortex generator. An annular plenum 271 is defined between the blowback generator 270 and an inner wall of the chemical treatment section 254. Optionally, a chemical vapor filter 272 may be received therein so as to adsorb chemical vapor present in the main gas being filtered, if required. In some instances, it may only be required to filter out particulates from the main gas.

[0090] The motor unit section 256 is positioned on top of the chemical treatment section 254 and has a flow generator 280 so as to create a flow of the main gas through the filtration system 250. The air exits from the motor unit section 256 through the outlet 281.

[0091] In operation, the filtration system 250 of the third embodiment of the present invention has the flow generator 280 causing a flow of the main gas, (e.g., air) from the inlet 260 to the outlet 281. Particulates will be caught by the filter 262 of the particulate treatment section 252. The main gas will then reach the annular plenum 271, wherein the chemical vapor filter 272, if present, will remove unwanted chemical vapor. Thereafter, the main gas will exit through the outlet 281, having been subjected to the necessary treatments.

[0092] When the filter 262 becomes saturated with particulates, the blowback generator 270 is activated in order to create a reverse flow of the main gas through the filter 262. The particulates will be captured in the means 263, so as not to resaturate the filter 262.

[0093] The particulate treatment section 252, the chemical treatment section 254 and the motor unit section 256 are sealingly interconnected in order to prevent the main gas from exiting or entering at the interconnection between respective sections. For instance, latch mechanisms or other like mechanisms can be used to secure the sections 252, 254 and 256 to one another.

#### Fourth Embodiment of the Present Invention

[0094] Referring to Fig. 10, a filtration system in accordance with a fourth embodiment of the present invention is generally shown at 250'. The filtration system 250' is similar to the filtration system 250 of Fig. 9, but differs in that additional sections are provided. Accordingly, like elements will bear like reference numerals between Figs. 9 and 10.

[0095] The filtration system 250' has the particulate treatment section 252 and the motor unit section 256. The particulate treatment section 252 has the inlet 260, the inner cavity 261, the filter 262 and the means 263 for capturing the particulates. The motor unit section 256 has the flow generator 280 and an outlet 281 at a top end thereof.

[0096] The chemical treatment section 254 (Fig. 9) of the third embodiment has been replaced by a blowback section 300. Also, a chemical treatment section 302 is positioned on top of the outlet 281 of the motor unit section 256.

[0097] The blowback section 300 has a blowback generator 270 and a nozzle 310 between the blowback generator 270 and the filter 262. The nozzle 310 is used to render the blowback from the blowback generator 270 more effective in removing particulates from the filter 262. The blowback



section 300 also has the annular plenum 271, which, however, does not include any chemical vapor filter. The chemical vapor filter is present in the chemical treatment section 302, which is positioned on top of the motor unit section 256.

[0098] It is pointed out that the sections 252, 256, 300 and 302 of the filtration system 250' are separable from one another such that the filter portions can be changed and mechanical and electrical components can be accessed for service or replacement.

[0099] The filtration system 250' operates in similar fashion to the filtration system 250 of the third embodiment (Fig. 9). More specifically, the flow generator 280 creates a flow of a main gas (e.g., air), such that the gas with particulates and chemical vapor firstly passes through the particulate treatment section 252, whereat particulates are retained by the filter 262. Thereafter, the air is conveyed through the nozzle 310, through the annular plenum 271 and through the motor unit section 256 to reach the chemical treatment section 302, whereat chemical vapors and other unwanted gases will be removed from the main gas.

[00100] When the filter 262 of the particulate treatment section 252 becomes saturated with particulates, a blowback is triggered with the blowback generator 270 (herein illustrated as a vortex generator) creating a reverse flow that will remove particulates from the filter 262. The particulates are captured in the means 263 so as not to resaturate the filter 262.

[00101] The modular assembly of the filtration system 250' facilitates the removal of the particulate treatment section 252 and the chemical treatment section 302 when it comes time to replace the filters. The sections 252, 256, 300 and 302 are sealingly secured to one another (for instance, using latch mechanisms, gaskets and other means) in order to ensure that the main gas does not exit through the interconnection between these various sections.

[00102] The second, third and fourth embodiments are advantageous when used in situations where space is an issue. For example, vehicles (e.g., military vehicles) often require filtration systems according to the environment to which they are exposed (e.g., desert). The embodiments of Figs. 7 to 10 provide a space-efficient solution. Moreover, these embodiments may operate from a single electrical source, using a vortex generator. As vehicles are typically provided with electrical systems, the embodiments of Figs. 7 to 10 are well suited therefor.

**CLAIMS:**

1. An apparatus for filtering particulates from a fluid, comprising:

a casing defining an inner cavity having an inlet adapted to receive a flow of fluid, such that fluid enters the inner cavity, and an outlet through which fluid exits the inner cavity;

a filter associated with the outlet such that fluid exiting the inner cavity through the outlet passes through the filter, the filter being adapted to retain particulates beyond a predetermined size from a fluid flowing therethrough; and

a blowback generator adapted to cause a reverse flow of fluid through the outlet and into the inner cavity of the casing, so as to dislodge a portion of the particulates retained in the filter into the inner cavity.

2. The apparatus of claim 1, wherein the blowback generator is a vortex generator.

3. An apparatus for filtering particulates and an undesired gas from a main gas, comprising:

a particulate treatment station having a first inlet adapted to receive a main gas carrying particulates and an undesired gas, a first filter for retaining the particulates in the particulate treatment station, and a first outlet through which the main gas exits filtered of the particulates;

a chemical treatment station separated from the particulate treatment station and having a second inlet in fluid communication with the first outlet of the particulate treatment station so as to receive a supply of the main gas from the first outlet of the particulate treatment station, a second filter for reacting with the undesired gas to retain the undesired gas therein, and a second outlet

through which the main gas exits filtered of the undesired gas; and

a pressure differential system to cause a flow of the main gas through the particulate treatment station and the chemical treatment station.

Fig. 1

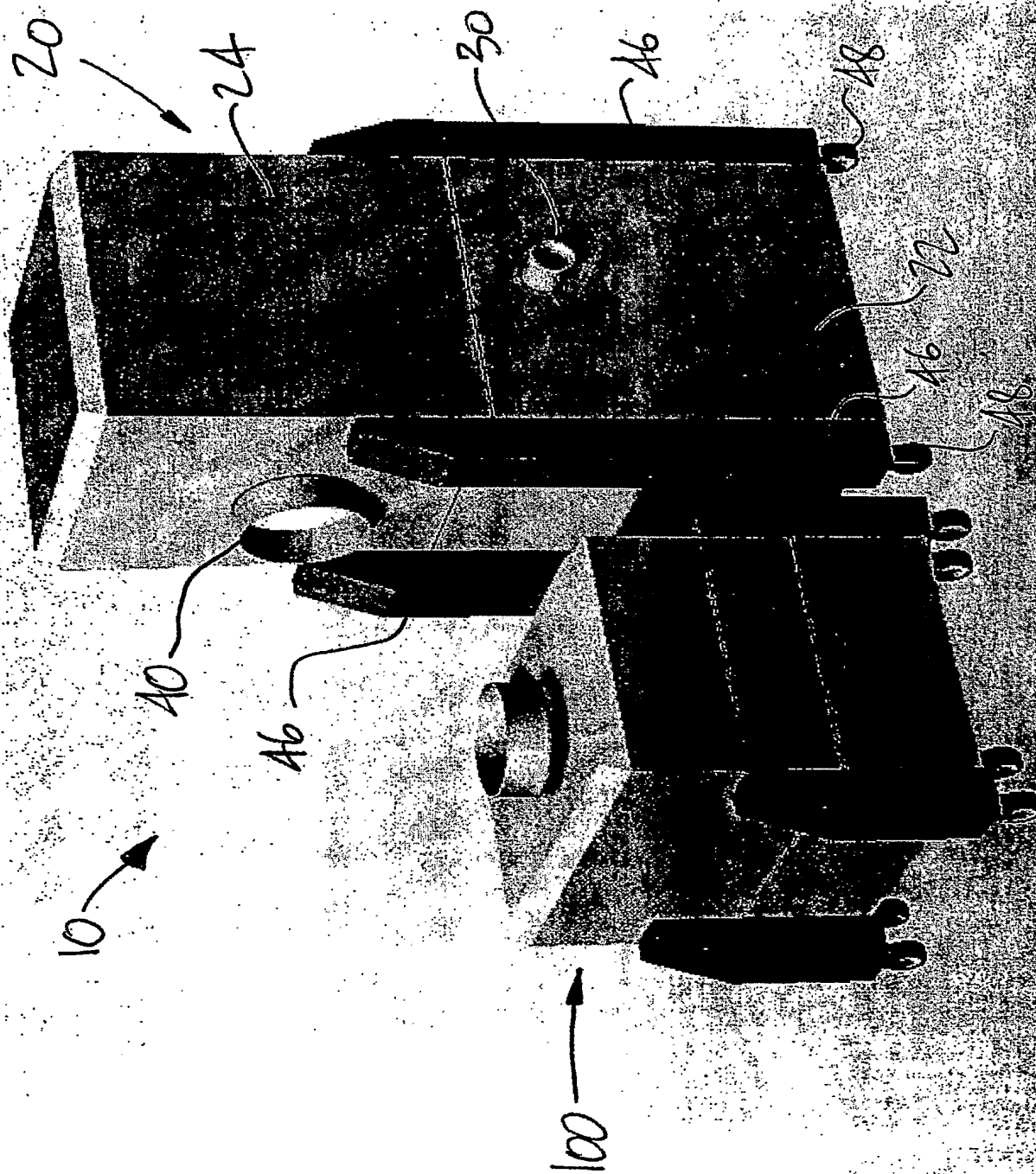


Fig. 2

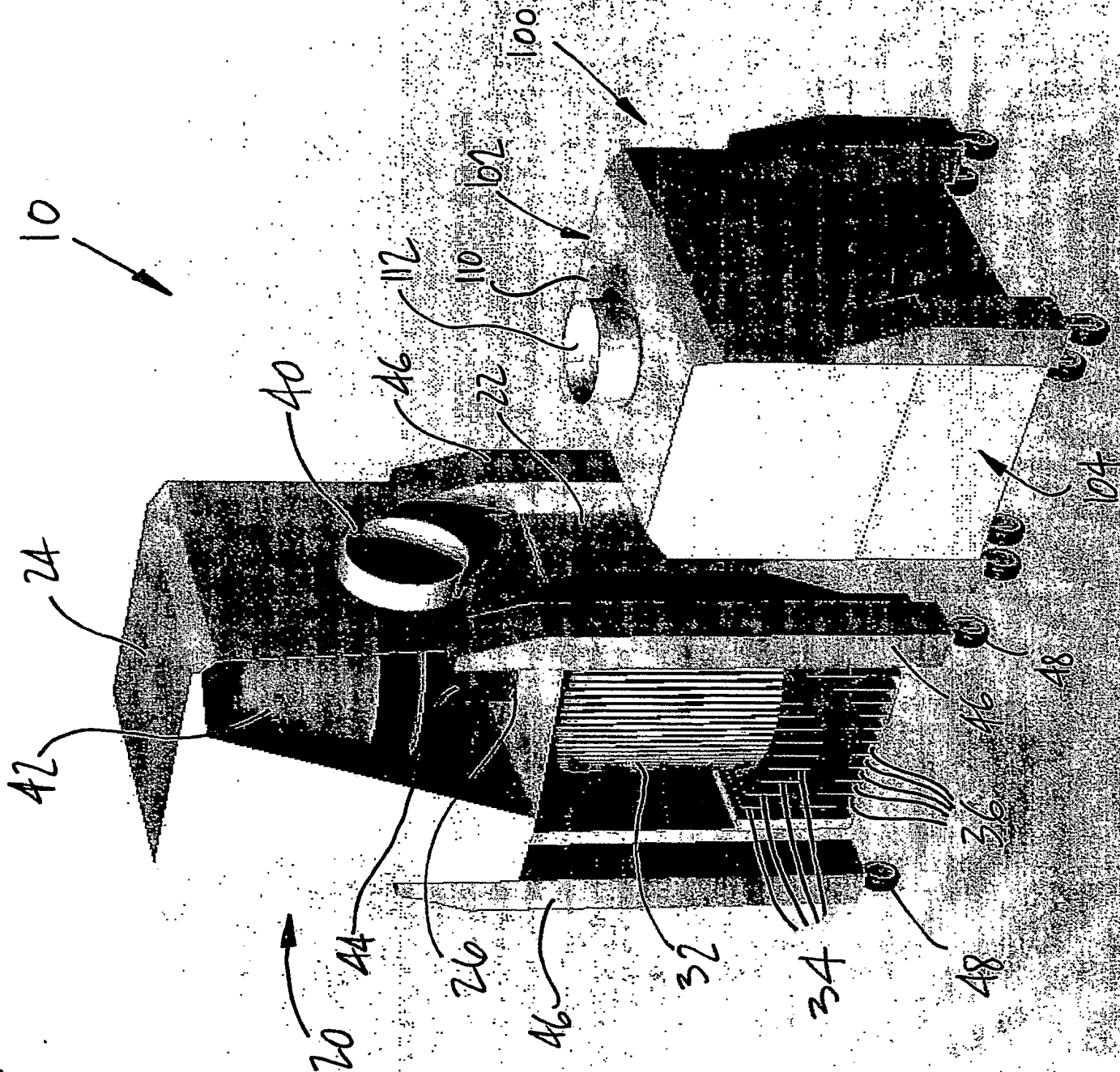


Fig. 3

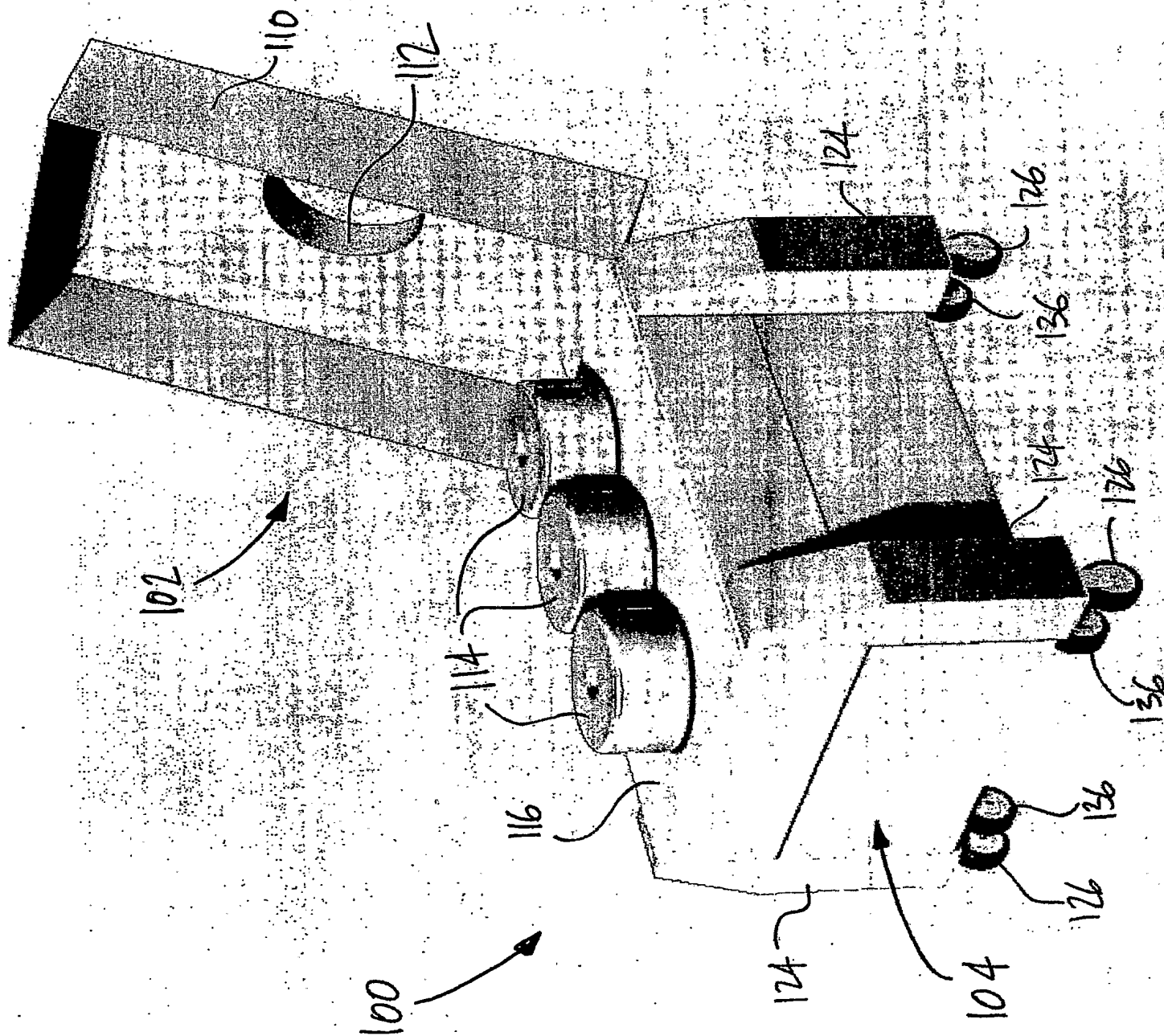


Fig. 4

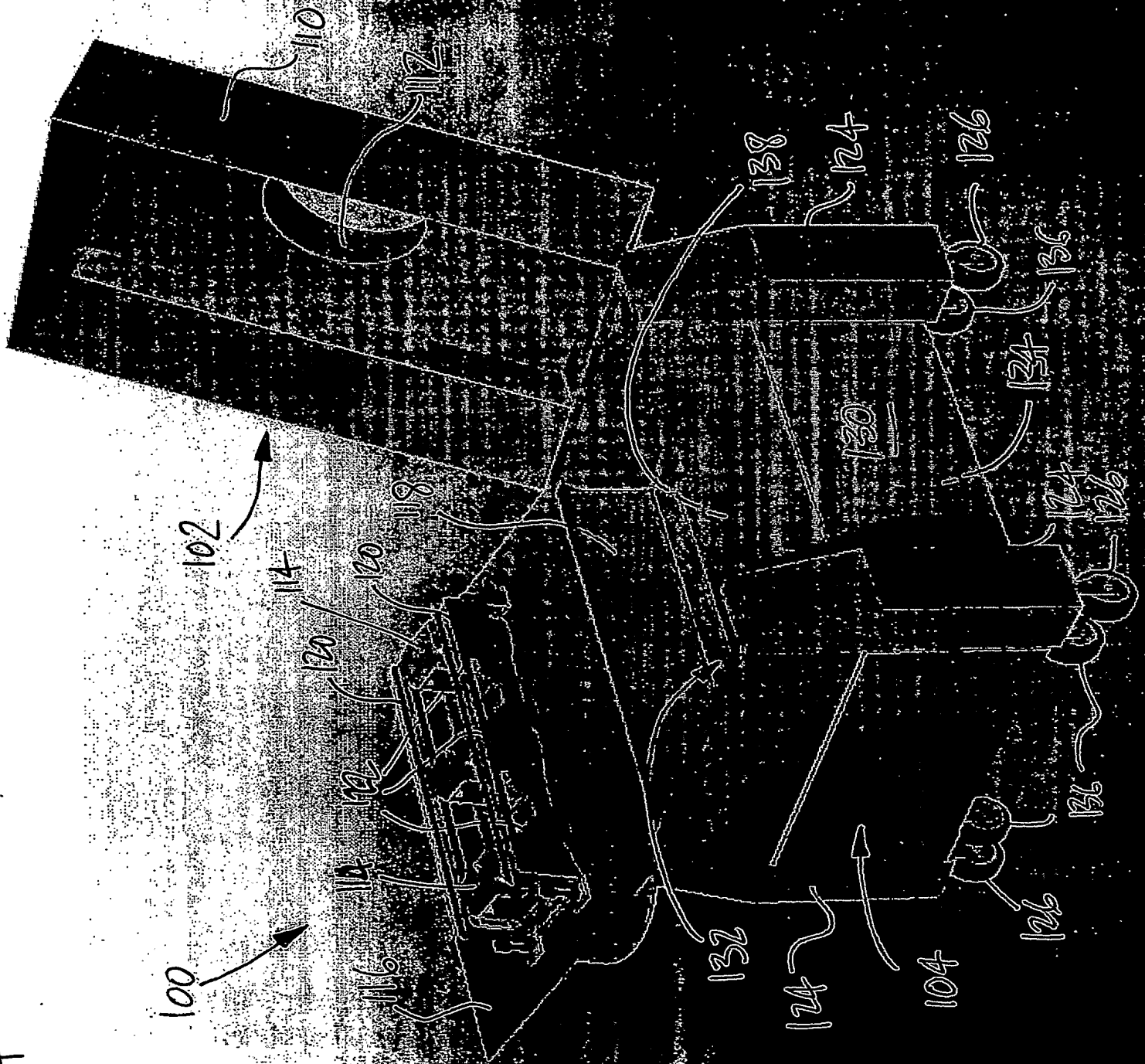




Fig. 5

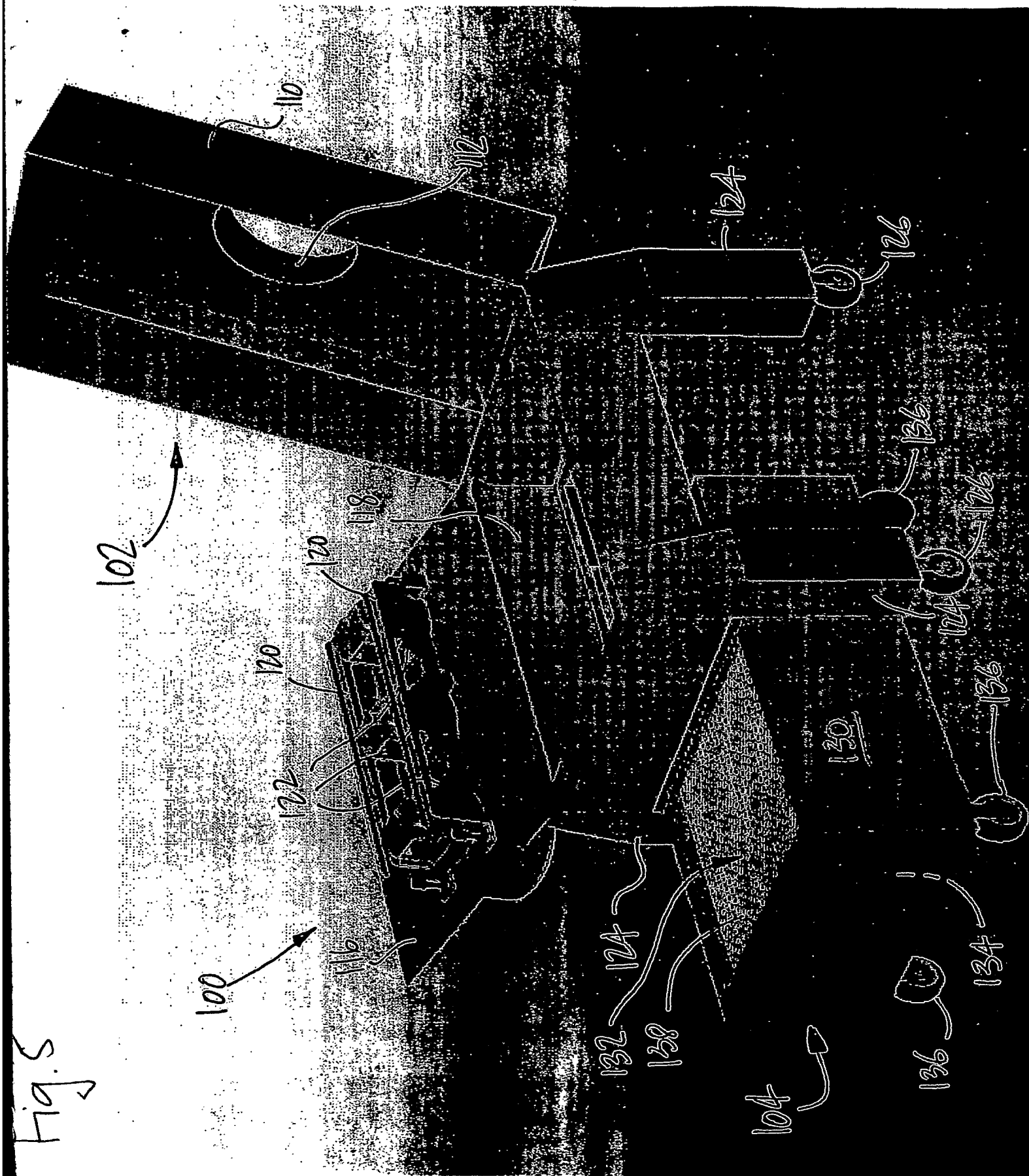
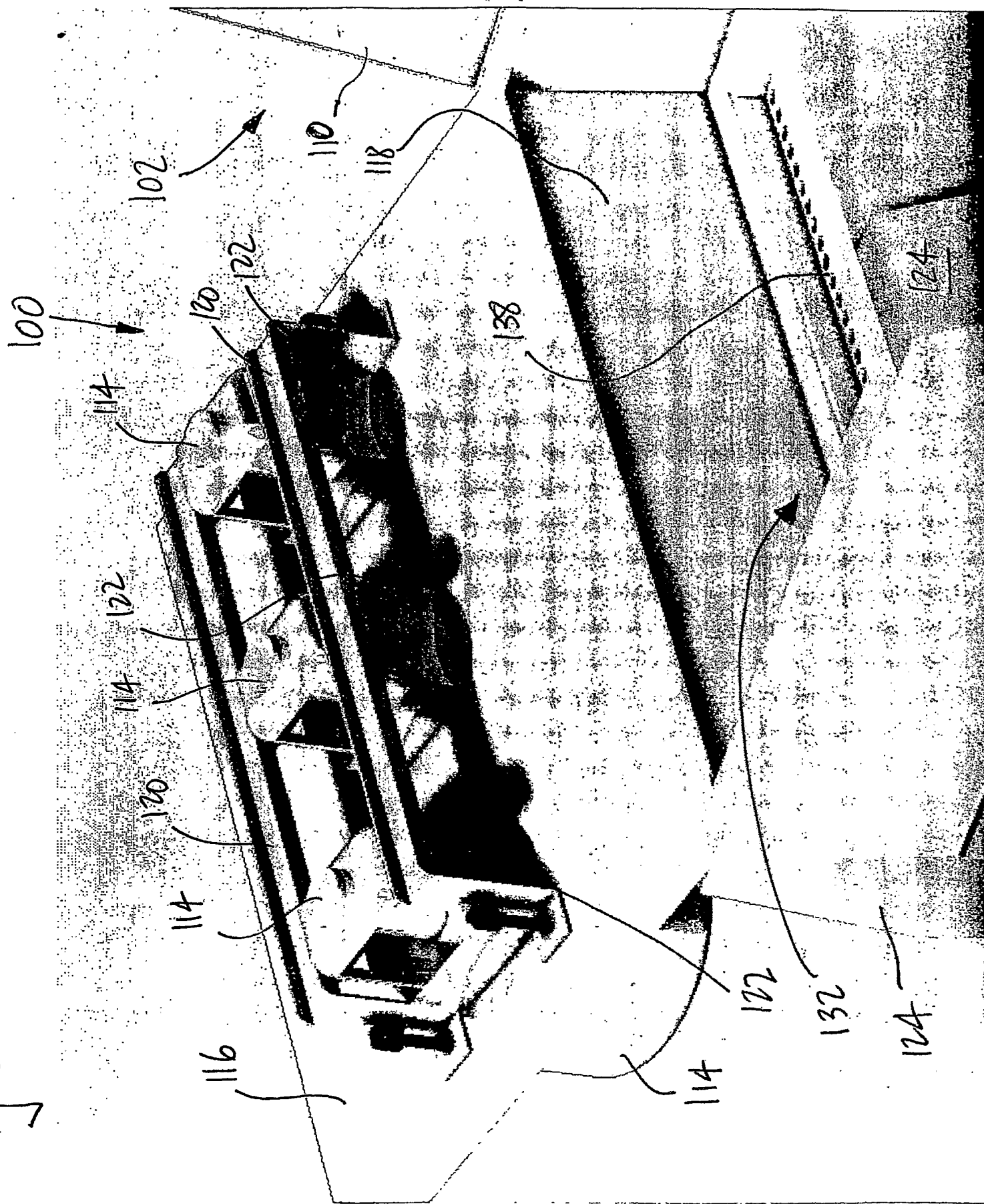
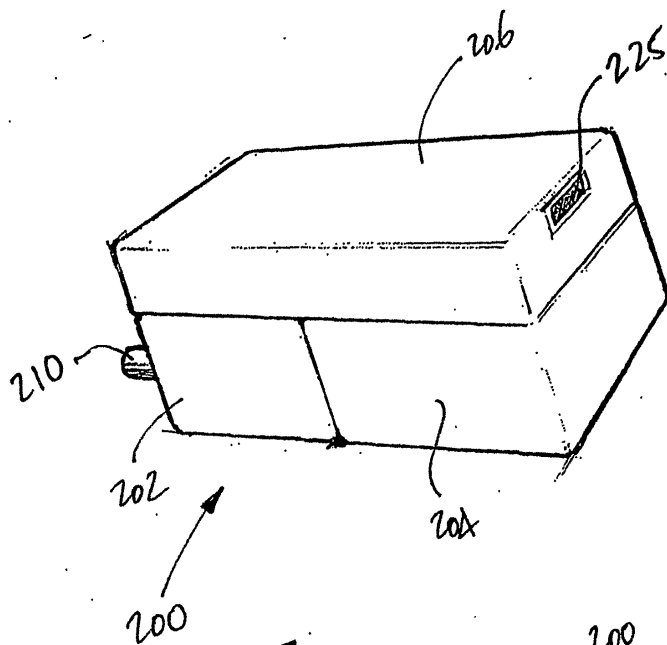
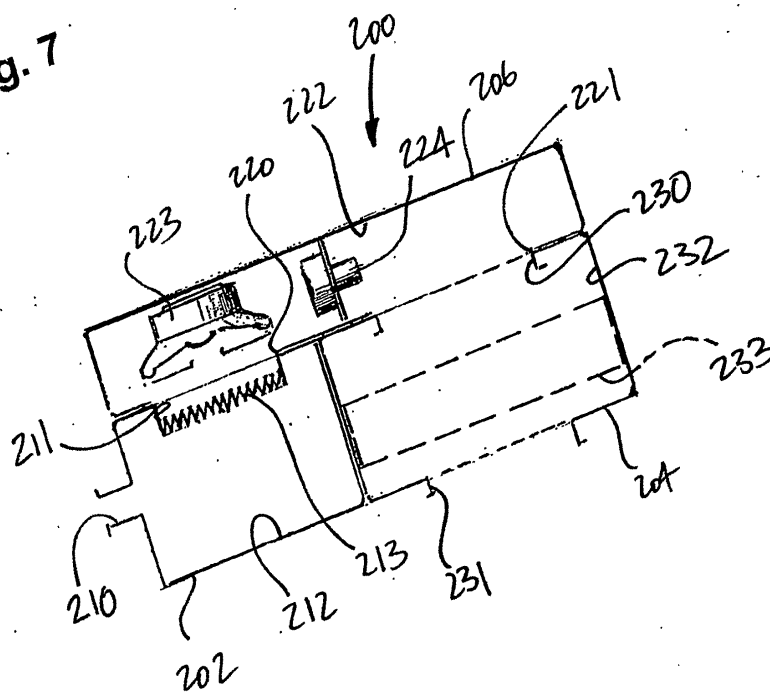


Fig. 6



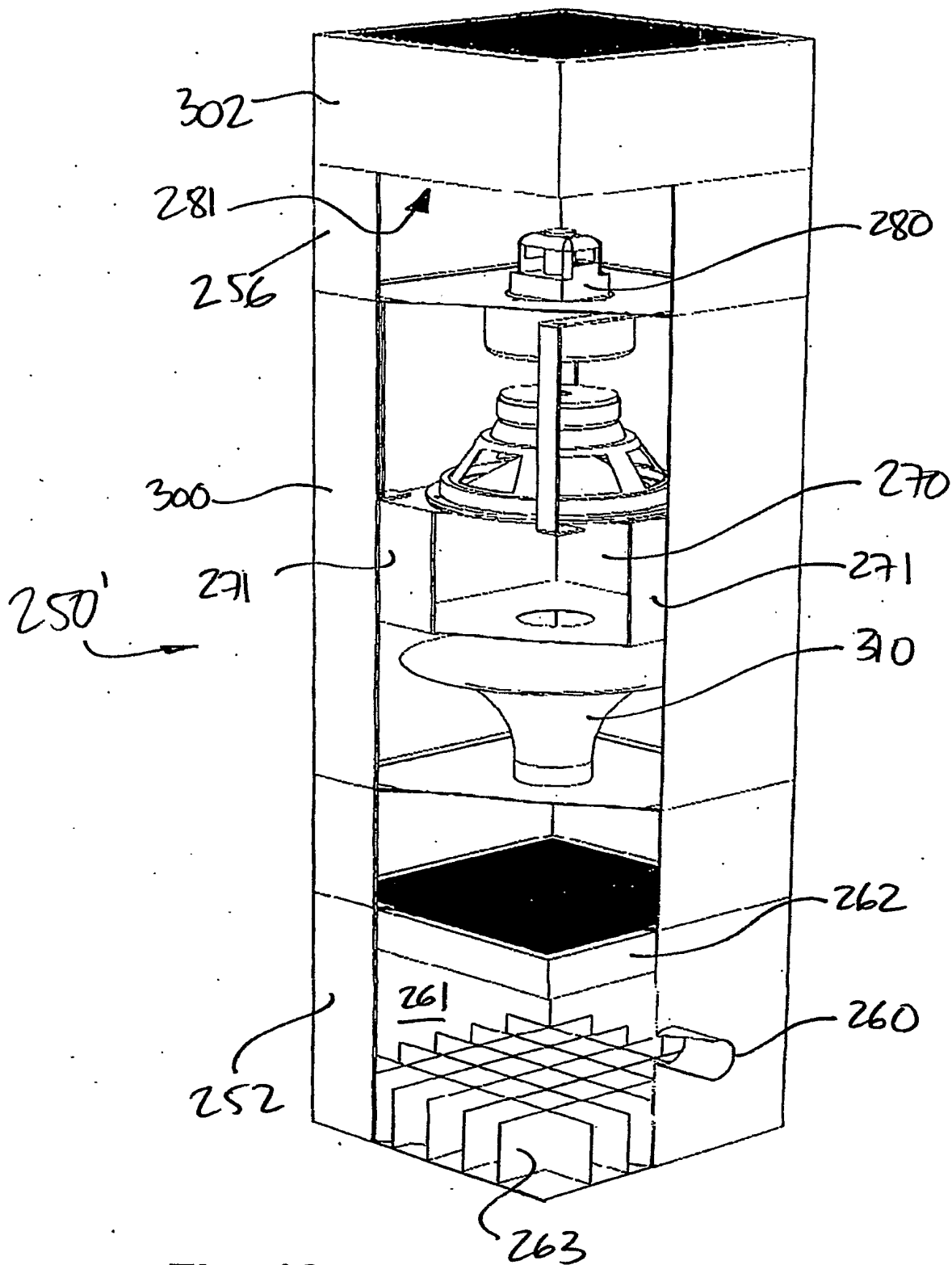


**Fig. 7**



**Fig. 8**





**Fig. 10**